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Bay Journal - Article: Hampton Roads treating wastewater till it's good enough to return to aquifer

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Hampton Roads treating wastewater till it's good enough to return to aquifer

Rebuilding depleted drinking water supply could also reduce rate of sea level rise, slash pollution

- Karl Blankenship March 15, 2017





*A pilot project at the York River Treatment Plant tested different technologies to turn wastewater into drinking water.
(Karl Blankenship)*

Little more than a day before, the water pouring from a tap outside the York River Treatment Plant had been wastewater: a mix of sewage flushed down toilets, soapy water drained from bathtubs, food wastes washed down the sink and industrial waste piped into sewer lines.

Now, the water coming out the silver spigot was crystal clear, filling a clean glass that said “SWIFT” on its side.

And it tasted like, well, water.

Despite its checkered past, the water was good enough to drink —maybe too good, according to officials from the [Hampton Roads Sanitation District](#), which operates the York River plant and a dozen others in southeastern Virginia. Instead of just treating wastewater and discharging it into the river as they’ve done for decades, district officials say they’ve now produced a valuable resource that can solve multiple problems facing the region.

“We don’t have to waste the water,” said Jamie Heisig-Mitchell, the HRSD’s chief of technical services. “We can actually use it for something that benefits the state.”

In an effort that may redefine what is doable at the region’s wastewater treatment plants, the district is proposing to take the treated wastewater from seven of its nine largest facilities, then treat it again to meet drinking water standards.

But instead of having people drink it, they want to pump it into a deep aquifer underlying the region. That would help rebuild eastern Virginia’s depleted water supply, they said, as well as reduce the rapid rate of sea level rise in the Hampton Roads area. It would also slash nutrient discharges far beyond what the district must do to meet Bay cleanup goals. Hence the SWIFT acronym, which stands for [Sustainable Water Initiative for Tomorrow](#).

Supporters say the \$1 billion project could provide all of those benefits without increasing costs for the district’s ratepayers beyond what’s currently projected — if the district is allowed to postpone some needed fixes to address sewer overflows.

The project represents a huge change in thinking for the regional agency which, since its creation in the 1940s, has focused simply on treating wastewater and discharging it into the river. “We spend our lives trying to improve the environment, but we still pollute,” said Ted Henifin, general manager of the sanitation district. “We put out water that is highly treated and meets the needs of the receiving water body, but we don’t feel great at the end of the day. “We are going to feel wonderful if we can pull this off.”

Local governments are on board because it could also substantially reduce costs to control stormwater runoff. State officials credit the sanitation district for the kind of innovative thinking they say is needed to not only help meet Bay cleanup goals — but to maintain those reduced nutrient pollution levels into the future.

Environmental groups also agree the concept has merit, though they want to see more details. They are concerned that, while the project helps the region’s big rivers and the Bay, it could delay improvements to local streams.

Nonetheless, the vision put forward by HRSD has injected an air of optimism into environmental discussions at a time when issues facing the Bay are often expensive — and complicated — said Peggy Sanner, assistant director and senior attorney with the [Chesapeake Bay Foundation](#)’s Virginia office.

“We all furrow our brows, and we trudge forward,” she said. Then, she added, “you go to meetings where SWIFT is discussed, and everybody leaves with a lighter heart.”

“People are understandably excited by it, but we can’t abandon caution.”

A new direction

The district has never been in the drinking water business. The HRSD was created by the state as an independent agency with its own rate-setting authority to clean up sewage problems in Southeast Virginia which, back then, were contaminating shellfish beds and swimming beaches.

Today, it handles wastewater for 1.7 million people — collectively, more than any other utility in the state. Its 13 plants treat 160 million gallons a day, and serve 18 cities or counties.

The genesis of the SWIFT project, officials said, came as the district engaged in long-range planning the last couple of years. It had invested \$500 million over the previous decade to upgrade its wastewater treatment plants to meet Bay nutrient reduction goals.

Still, officials realized that more costly requirements could be coming. There are growing concerns about various emerging contaminants in wastewater discharges that can harm aquatic life, such as pharmaceuticals and personal care products. And, if other nutrient sources don’t meet their Bay cleanup goals, wastewater plants could be on the hook to make up the difference.

HRSD officials worried that they could face a series of incremental, and potentially costly, upgrade requirements in the future. Further Bay-related nutrient reduction upgrades alone could cost another \$750 million, according to district estimates.

Officials began toying with the idea of incorporating the maximum feasible treatment technology at their plants. “Our thought process was ‘let’s take our water all the way to drinking water, and maybe the regulators won’t do anything more to us,’ ” Henifin said. But it would be clean drinking water that’s not immediately needed in the Hampton Roads area, which relies on reservoirs for most of its supply and already has treatment plants to handle that.

Then, officials hit on the idea of injecting their treated water into the ground. The region sits above the huge Potomac Aquifer, a major water source for much of Eastern Virginia. Commercial and residential wells there pump out an estimated 144 million gallons a day, which far exceeds its recharge rate.

Those withdrawals also contribute to land subsidence in the region. Water levels in the Hampton Roads region are rising at the rate of about 4 millimeters a year — the highest pace in the nation outside New Orleans. About half of that is attributed to rising sea levels, and the other half to sinking land — much of the latter caused by withdrawals from the Potomac Aquifer.

Also, it is a confined aquifer, which means it’s largely surrounded by dense layers of rock and clay, so water in the Potomac Aquifer was pressurized — so much so that when wells were first drilled into it, the water came out on its own, without the need for pumps.

That's no longer the case today. And as pressure in the aquifer has been reduced, scientists are worried it could start drawing in salty ocean water, ruining the aquifer as a drinking-water source. The potential lack of a reliable water supply has raised concerns about future economic growth in much of the state east of Interstate 95, which is above the aquifer. The HRSD plan would pump 120 million gallons a day of treated drinking water into the ground. That — along with natural recharge — would help re-pressurize the aquifer, prevent saltwater intrusion and maintain it as a viable water source.

"There will be no development in eastern Virginia if we don't have a water source," Henifin said. "So, putting this water into the aquifer really creates a future for eastern Virginia that doesn't exist."

Although the greatest impact would be in Virginia, computer modeling shows that the benefits of repressurizing the aquifer would actually reach into Maryland and North Carolina, he said. Injecting treated water could slow the rate of sea level rise in Hampton Roads. The region is already suffering from increasing rates of flooding, and whole city blocks in Norfolk are being elevated for protection. Tidal marshes, which provide valuable habitat for many species, are being lost faster than they can migrate to higher ground.

Injecting water won't end sea level rise, but will reduce the rate by about a quarter, giving localities — and ecosystems — more time to adapt. "No one has put a value on that, but it's huge," Henifin said.

Not a new concept

The sanitation district last year began experimenting with treatment technologies that can purify wastewater into drinking water at its York River plant in Seaford. This year, it's building a larger demonstration project at its Nansemond treatment plant in Suffolk, which will be capable of processing 1 million gallons a day, then pumping it into the aquifer.

If no problems crop up after that project has run for a year, the HRSD would like to move forward with incorporating the technology at seven of its nine largest plants. (One of the others discharges into the Atlantic Ocean and is not bound by Bay cleanup requirements, and the other is being retired.)

While no other place in the state is doing precisely what the Hampton Roads district plans, other utilities are doing aspects of it. In Northern Virginia, the discharge from an upstream wastewater treatment plant flows into the Occoquan Reservoir, from which the Fairfax County Water Authority draws and treats drinking water. In the Hampton Roads area, the city of Chesapeake pumps excess treated drinking water into an aquifer, where it is stored until it's needed during dry spells.

But across the nation, California's Orange County has been injecting heavily treated wastewater into its aquifer, as the HRSD is proposing, for four decades. Today, it's injecting about 100 million gallons daily.

“We see wastewater not as a waste, but as a resource,” said Michael Markas, general manager of the [Orange County Water District](#), at a workshop last December sponsored by the [William & Mary Law School](#).

The process takes less energy than it does to pump water from Northern California or the Colorado River, Markas said, and it’s considerably less expensive than desalinating ocean water. One concern voiced by scientists and others is that new chemicals, or those not recognized as problems today, could inadvertently be pumped into the aquifer and pose a threat in the future. The district has a scientific advisory panel to identify potential new contaminants; it is now testing for about 400 substances, but none has reached levels of concern in treated water, Markas said.

The nonprofit [National Water Research Institute](#) has organized a similar expert panel to advise the HRSD.

HRSD officials also note that no one will be drinking any of their injected water anytime soon. Groundwater near the proposed aquifer injection points only moves at the rate of 3–30 feet per year. The nearest wells to any of those sites are more than a mile away, and some of those go into shallower groundwater above the Potomac aquifer. The HRSD is planning a survey of wells near proposed injection points.

“It could be hundreds of years before anyone would be withdrawing the actual water molecules that we put in there into their wells,” Henifin said. By that time, any potential contaminants of concern would have been considerably diluted by other aquifer water, he said. Further, the contaminants would likely have been filtered out by passing through the clay and sediment particles in the aquifer, part of the natural cleansing system in groundwater.

Covering the cost

The sanitation district is under a court-approved consent decree requiring it to address overflows of raw, but diluted, waste from its sewer system, which take place during heavy or prolonged rains when the ground is soaked and water infiltrates into the sewer lines.

Those overflows amount to about 5 million gallons annually, a fraction of the 160 million gallons of effluent the district’s facilities treat daily. But the HRSD estimates it would cost \$2.2 billion to fix.

To make the \$1 billion SWIFT project possible, the district will propose, in a plan due to the [U.S. Environmental Protection Agency](#) in October, that most of the sewer overflow work be delayed. Instead, the HRSD would use the funds now planned for sewer repairs to turn wastewater into drinking water and inject it back into the aquifer. That, they argue, would slash the HRSD’s nitrogen discharges into the James River from 3.4 million pounds annually now, to 500,000 pounds.

Henifin said the HRSD still plans to address some sewer overflow issues — those with the greatest public threat — but the bulk of the improvements would be put off until after 2030 when the SWIFT project is completed.

At about that time, he said, the bonds that were used to finance Bay-related wastewater upgrades a decade ago will begin expiring, freeing up money to complete the sewer overflow work without major rate increases.

“By rearranging some things, and slowing down the wet weather work, we can actually put [SWIFT] in front without changing that rate projection,” Henifin said. “We really believe with the environmental benefits of this project, this is the one to work on first.”

Environmental concerns

Environmental groups credit the HRSD for putting forward an innovative proposal that could accelerate the nutrient cleanup of large rivers in the area, as well as the Chesapeake. But they also have some concerns, particularly about whether smaller creeks and other local waters would share in the broader benefits.

Because some sewer overflow work would be delayed, environmental groups would like more details about how fixes would be prioritized, and how long it would take before the upgrades are completed.

Likewise, they want to keep an eye on the technologies being used for SWIFT, as well as the safeguards that the sanitation district is planning — including trying to anticipate issues, such as new contaminants, that may not be evident for years.

“It is new, and there are just a lot of questions that go along with that,” said Jamie Brunkow, the [Lower James Riverkeeper](#). “Our job is to be a voice for the river so we try to keep an eye on any potential impacts that could come forward in the future.”

The biggest question that he and others have is what will become of the pollution reduction “credits” that will be generated if the sanitation district slashes its nutrient discharges far below what’s required — nearly eliminating them in many places.

The HRSD would like to see some of those credits used to reduce the burden on local governments in the area of meeting stringent stormwater pollution reduction requirements set in the [Chesapeake Bay Total Maximum Daily Load](#), or pollution diet, which are to be met by 2025. Although the HRSD is not responsible for stormwater, Henifin said the same ratepayers are paying for both projects and should get some financial relief. By some estimates, Bay-related stormwater improvements could cost communities in the Hampton Roads area about \$1.8 billion.

The SWIFT project would make huge nutrient reductions compared with the relatively modest ones to be achieved through stormwater controls. The biggest impact of the project would be in the large tidal rivers, where wastewater discharges would largely come to an end.

Smaller creeks, though, tend to benefit more from stormwater upgrades, environmentalists contend. “There are a lot of people who fish boat and swim in those areas, and stormwater is really their biggest concern,” Brunkow said. “It is not the wastewater.”

Sanner, of the CBF, said local officials have indicated stormwater work would continue, albeit at a slower pace, but “we’d like to see that spelled out.”

Only a handful of credits would be needed to offset stormwater improvements, though.

Another looming concern for environmentalists is what would happen with the potentially millions of pounds of nutrient credits that would remain.

Virginia has regulations that restrict how such trades could take place, and typically, trading is supposed to occur in areas near where reductions are made. But environmentalists worry the surplus credits will create a temptation to allow increased nutrient discharges in more distant places — perhaps even other river basins — than is currently allowed.

“We need to be aware of that possibility,” Sanner said. She suggested that a portion of the credits should be “retired” and not used at all.

Long-term implications

Russ Baxter, Virginia deputy secretary of natural resources for the Chesapeake Bay, acknowledged that the proposal, if it goes ahead, will create issues “and we’re going to have to work through those.”

But he is hopeful that the project will help spur innovations by other treatment plant operators. The HRSD is the largest wastewater entity in the state and is better situated to undertake a unique project — which requires a lot of experimentation and monitoring — than most others. “But there may be things that are learned or technologies that are used in this that will help other, smaller plants examine different ways of water reuse,” Baxter said.

He credited the HRSD for “going out on a limb” with a proposal that deals with multiple regional problems when all it had to do was address a sewer overflow problem. Most importantly, he said, the sanitation district is tackling one of the biggest issues facing the region — how nutrient reductions would be maintained after the 2025 Bay cleanup deadline, even as the region continues to grow.

“They’re not thinking about tomorrow. They are thinking about serving a growing area over the long term, and how they are going to do that while protecting water quality,” Baxter said.

“So, I give them a lot of credit, because that is the way we have to think now.

“All of this doesn’t stop in 2025. It keeps going on and on.”